Claims

We claim:

1. A microarray of polymeric biomaterials comprising:

a base comprising a cytophobic surface; and

a plurality of discrete polymeric biomaterial elements non-covalently bound to said cytophobic surface.

2. A microarray of polymeric biomaterials comprising:

a base comprising a cytophobic surface; and

a plurality of discrete non-monolayer polymeric biomaterial elements bound to said cytophobic surface.

3. The microarray of claim 1 or 2, wherein said base comprises a material selected from the group consisting of glass, plastic, metal, ceramic, and combinations thereof.

4. The microarray of claim 1 or 2, wherein said cytophobic surface comprises a hydrogel.

5. The microarray of claim 4, wherein said hydrogel comprises a polymer selected from the group consisting of homopolymers of methacrylic acid esters, homopolymers of alkylene oxides, homopolymers of alkylene glycols, copolymers thereof, and mixtures thereof.

6. The microarray of claim 4, wherein said hydrogel comprises a polymer selected from the group consisting of poly(methyl methacrylate), poly(isobutyl methacrylate), poly(pentyl methacrylate), poly(2-hydroxy-ethyl methacrylate), copolymers thereof, and mixtures thereof.

7. The microarray of claim 4, wherein said hydrogel comprises a polymer selected from the group consisting of poly(ethylene oxide), poly(propylene 1,2-glycol), poly(propylene 1,3-glycol), copolymers thereof, and mixtures thereof.

8. The microarray of claim 1, wherein said polymeric biomaterial elements are bound to said cytophobic surface via a non-covalent interaction selected from the group consisting of chemical adsorption, hydrogen bonding, surface interpenetration, ionic bonding, van der Waals forces, hydrophobic interactions, magnetic interactions, dipole-dipole interactions, and combinations thereof.

9. The microarray of claim 2, wherein said polymeric biomaterial elements are bound to said cytophobic surface via an interaction selected from the group consisting of chemical adsorption, hydrogen bonding, surface interpenetration, covalent bonding, ionic bonding, van der Waals forces, hydrophobic interactions, magnetic interactions, dipole-dipole interactions, and combinations thereof.

10. The microarray of claim 1 or 2, wherein each of said polymeric biomaterial elements comprises at least one polymer selected from the group consisting of synthetic polymers, adducts thereof, and mixtures thereof.

11. The microarray of claim 10, wherein said synthetic polymers are selected from the group consisting of polyamides, polyphosphazenes, polypropylfumarates, synthetic poly(amino acids), polyethers, polyacetals, polycyanoacrylates, polyurethanes, polycarbonates, polyanhydrides, poly(ortho esters), polyhydroxyacids, polyesters, polyacrylates, ethylene-vinyl acetate polymers, cellulose acetates, polystyrenes, poly(vinyl chloride), poly(vinyl fluoride), poly(vinyl imidazole), poly(vinyl alcohol), and chlorosulphonated polyolefins.

12. The microarray of claim 10, wherein at least one of said polymeric biomaterial elements further comprises a compound selected from the group consisting of drugs, growth factors, combinatorial compounds, proteins, polysaccharides, polynucleotides, lipids, adducts thereof, and mixtures thereof.

13. The microarray of claim 12, wherein said compound is covalently bound to the synthetic polymer component or components of the polymeric biomaterial.

14. The microarray of claim 12, wherein said compound is non-covalently bound to the synthetic polymer component or components of the polymeric biomaterial.

15. The microarray of claim 1 or 2, wherein each of said polymeric biomaterial elements are between 10 and 1000 μm in diameter.

16. The microarray of claim 1 or 2, wherein each of said polymeric biomaterial elements are between 50 and 500 μm in diameter.

17. The microarray of claim 1 or 2, wherein said polymeric biomaterial elements are disposed at between 100 and 1200 μm intervals in a rectangular microarray.

18. The microarray of claim 1 or 2, wherein said polymeric biomaterial elements are disposed at between 300 and 500 μm intervals in a rectangular microarray.

19. The microarray of claim 1 or 2, wherein said polymeric biomaterial elements are present at a density on said cytophobic surface that ranges from 1 to 1,000 polymeric biomaterial elements per cm^2.

20. The microarray of claim 1 or 2, wherein said polymeric biomaterial elements are present at a density on said cytophobic surface that ranges from 10 to 100 polymeric biomaterial elements per cm^2.

21. A method for the high throughput screening of polymeric biomaterials for their ability to affect cellular behavior comprising:

providing a microarray of polymeric biomaterial elements that are bound to a cytophobic surface;

contacting said microarray with a cell culture for a period of time sufficient to allow the cells to adhere to said polymeric biomaterial elements; and

assaying the cellular behavior for each polymeric biomaterial element of the microarray.

22. The method of claim 21, wherein said cytophobic surface comprises a hydrogel.

23. The method of claim 22, wherein said hydrogel comprises a polymer selected from the group consisting of homopolymers of methacrylic acid esters, homopolymers of alkylene oxides, homopolymers of alkylene glycols, copolymers thereof, and mixtures thereof.

24. The method of claim 22, wherein said hydrogel comprises a polymer selected from the group consisting of poly(methyl methacrylate), poly(isobutyl methacrylate), poly(pentyl methacrylate), poly(2-hydroxy-ethyl methacrylate), copolymers thereof, and mixtures thereof.

25. The method of claim 22, wherein said hydrogel comprises a polymer selected from the group consisting of poly(ethylene oxide), poly(propylene 1,2-glycol), poly(propylene 1,3-glycol), copolymers thereof, and mixtures thereof.

26. The method of claim 21, wherein said polymeric biomaterial elements are non-covalently bound to said cytophobic surface.

27. The method of claim 26, wherein said polymeric biomaterial elements are bound to said cytophobic surface via a non-covalent interaction selected from the group consisting of chemical adsorption, hydrogen bonding, surface interpenetration, ionic bonding, van der Waals forces, hydrophobic interactions, magnetic interactions, dipole-dipole interactions, and combinations thereof.

28. The method of claim 21, wherein said polymeric biomaterial elements are not monolayers.

29. The method of claim 21, wherein each of said polymeric biomaterial elements comprises at least one polymer selected from the group consisting of synthetic polymers, adducts thereof, and mixtures thereof.

30. The method of claim 29, wherein said synthetic polymers are selected from the group consisting of polyamides, polyphosphazenes, polypropylfumarates, synthetic poly(amino acids), polyethers, polyacetals, polycyanoacrylates, polyurethanes, polycarbonates, polyanhydrides, poly(ortho esters), polyhydroxyacids, polyesters, polyacrylates, ethylene-vinyl acetate polymers, cellulose acetates, polystyrenes, poly(vinyl chloride), poly(vinyl fluoride), poly(vinyl imidazole), poly(vinyl alcohol), and chlorosulphonated polyolefins.

31. The method of claim 29, wherein at least one of said polymeric biomaterial elements further comprises a compound selected from the group consisting of drugs, growth factors, combinatorial compounds, proteins, polysaccharides, polynucleotides, lipids, adducts thereof, and mixtures thereof.

32. The method of claim 31, wherein said compound is covalently bound to the synthetic polymer component or components of the polymeric biomaterial.

33. The method of claim 31, wherein said compound is non-covalently bound to the synthetic polymer component or components of the polymeric biomaterial.

34. The method of claim 21, wherein said polymeric biomaterial elements are between 10 and 1000 μm in diameter.

35. The method of claim 21, wherein said polymeric biomaterial elements are between 50 and 500 μm in diameter.

36. The method of claim 21, wherein:

said microarray is a rectangular microarray; and

said polymeric biomaterial elements are disposed at between 100 and 1200 μm intervals on said cytophobic surface.

37. The method of claim 21, wherein:

said microarray is a rectangular microarray; and

said polymeric biomaterial elements are disposed at between 300 and 500 μm intervals on said cytophobic surface.

38. The method of claim 21, wherein said polymeric biomaterial elements are present at a density on said cytophobic surface that ranges from 1 to 1,000 polymeric biomaterial elements per cm^2.

39. The method of claim 21, wherein said polymeric biomaterial elements are present at a density on said cytophobic surface that ranges from 10 to 100 polymeric biomaterial elements per cm^2.

40. The method of claim 21, wherein said cells are selected from the group consisting of mammalian cells, bacterial cells, yeast cells, and plant cells.

41. The method of claim 21, wherein said cells are selected from the group of mammalian cells consisting of chondrocytes, fibroblasts, connective tissue cells, epithelial cells, endothelial cells, cancer cells, hepatocytes, islet cells, smooth muscle cells, skeletal muscle cells, heart muscle cells, kidney cells, intestinal cells, organ cells, lymphocytes, blood vessel cells, stem cells, human embryonic stem cells, and mesenchymal stem cells.

42. The method of claim 21, wherein the step of assaying comprises assaying for cellular proliferation.

43. The method of claim 21, wherein the step of assaying comprises assaying for cellular differentiation.

44. The method of claim 21, wherein the step of assaying comprises assaying for gene expression.

45. A method of preparing a microarray of polymeric biomaterials comprising:

providing a base comprising a substrate surface;

providing polymeric biomaterials in a solvent selected from the group consisting of dimethylformamide, dimethylsulfoxide, chloroform, and dichlorobenzene; and

depositing said polymeric biomaterials as a plurality of discrete elements on said substrate surface using a robotic liquid handling device, wherein

said polymeric biomaterials are dissolved at a concentration of between 10 and 200 mg/ml in said solvent, and said substrate surface comprises a hydrogel.

46. The method of claim 45, wherein said liquid handling device deposits via pin fluid deposition.

47. The method of claim 45, wherein said liquid handling device deposits via syringe pumped fluid deposition.

48. The method of claim 45, wherein said liquid handling device deposits via piezoelectric fluid deposition.

49. The method of claim 45, wherein said polymeric biomaterial elements are deposited as drops of between 0.1 and 100 nl.

50. The method of claim 45, wherein said polymeric biomaterial elements are deposited as drops of between 1 and 10 nl.

51. A method for the high throughput screening of compounds for their ability to affect cellular behavior comprising:

providing a microarray of polymeric biomaterial elements arranged on a cytophobic surface;

contacting said polymeric biomaterial elements with a cell culture for a period of time sufficient to allow the cells to adhere to said polymeric biomaterial elements; and

assaying the cellular behavior for each polymeric biomaterial element of the microarray, wherein:

at least one of said polymeric biomaterial elements comprises one of said compounds.

52. The method of claim 51, wherein said compounds are drugs.

53. The method of claim 51, wherein said compounds belong to a synthetic combinatorial library of compounds

54. The method of claim 51, wherein said compounds are selected from the group consisting of proteins, polysaccharides, polynucleotides, lipids, adducts thereof, and mixtures thereof.